

Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. - 77. (cancelled)

78. (new) A process for making a metallic substrate having a vitreous coating, wherein the process comprises

- (a) applying an alkali metal silicate-containing coating sol to the substrate to provide a coating layer on the substrate;
- (b) drying the applied coating layer at room temperature of up to 100°C to obtain a dried coating layer, and
- (c) thermally densifying the dried coating layer of (b) by a two-stage heat treatment comprising,
 - (i) in a first stage, a heat treatment carried out either (A) in an atmosphere comprising from 15 % to 90 % by volume of oxygen at an end temperature of from 350°C to 400°C, or (B) in a vacuum at a residual pressure of ≤ 15 mbar at an end temperature from 120°C to 500°C, and
 - (ii) in a second stage, further densification by a heat treatment in a low-oxygen atmosphere at an end temperature of from 400°C to 600°C up to full densification with formation of a vitreous layer;

P30123.A10

and wherein the process further comprises cooling the heat-treated substrate at a cooling rate of from 1 to 10 K/min.

79. (new) The process of claim 78, wherein the heat treatment of the first stage is carried out according to alternative (A).

80. (new) The process of claim 78, wherein the heat treatment of the first stage is carried out according to alternative (B).

81. (new) The process of claim 80, wherein the heat treatment of the first stage is carried out according to alternative (B) at an end temperature of up to about 200°C.

82. (new) The process of claim 80, wherein the heat treatment of the first stage is carried out according to alternative (B) at a residual pressure of ≤ 5 mbar.

83. (new) The process of claim 78, wherein the heat treatment of the first stage is carried out according to alternative (B) at a residual pressure of ≤ 5 mbar.

84. (new) The process of claim 78, wherein the heat treatment of the second stage is carried out at an end temperature of from 540° to 560°C.

85. (new) The process of claim 78, wherein the heat treatment of the second stage is carried

out in an atmosphere which comprises ≤ 0.5 % by volume of oxygen.

86. (new) The process of claim 84, wherein the heat treatment of the second stage is carried out in an atmosphere which comprises ≤ 0.5 % by volume of oxygen.

87. (new) The process of claim 78, wherein the heat treatment of the second stage is carried out in an inert gas atmosphere.

88. (new) The process of claim 78, wherein the alkali metal silicate-containing coating sol is obtainable by a process comprising a hydrolysis and polycondensation of one or more silanes of formula (I)



wherein the radicals X independently represent hydrolyzable groups or hydroxyl groups, the radicals R independently represent hydrogen, alkyl, alkenyl and alkynyl groups having up to 4 carbon atoms and aryl, aralkyl and alkaryl groups having from 6 to 10 carbon atoms, and n is 0, 1 or 2, with the proviso that at least one silane where n = 1 or 2 is used, or oligomers derived therefrom, in the presence of

- (a) at least one compound selected from oxides and hydroxides of alkali metals and alkaline earth metals, and
- (b) optionally, nanoscale SiO₂ particles.

P30123.A10

89. (new) The process of claim 88, wherein the at least one compound is used in such an amount that an atomic ratio Si : (alkali metal and/or alkaline earth metal) is in a range of from 20:1 to 7:1.

90. (new) The process of claim 89, wherein the atomic ratio is from 15:1 to 10:1.

91. (new) The process of claim 90, wherein an average value of n in the silanes of formula (I) is from 0.2 to 1.5.

92. (new) The process of claim 91, wherein the average value of n is from 0.5 to 1.0.

93. (new) The process of claim 78, wherein a thickness of the vitreous layer is from 2.5 to 4.5 μm .

94. (new) The process of claim 78, wherein the substrate has a structured surface.

95. (new) The process of claim 94, wherein the substrate comprises at least one of steel, stainless steel, zinc-plated steel, chromium-plated steel and enameled steel.

96. (new) A process for making a metallic substrate having a vitreous coating, wherein the process comprises

(a) applying an alkali metal silicate-containing coating sol to the substrate to provide a

coating layer on the substrate;

(b) drying the applied coating layer at room temperature of up to 100°C to obtain a dried coating layer, and

(c) thermally densifying the dried coating layer of (b) by a two-stage heat treatment comprising,

(i) in a first stage, a heat treatment carried out either (A) in an atmosphere comprising from 15 % to 90 % by volume of oxygen at an end temperature of up to 400°C, or (B) in a vacuum at a residual pressure of ≤ 15 mbar at an end temperature of up to 500°C, and

(ii) in a second stage, further densification by a heat treatment in a low-oxygen atmosphere at an end temperature of from 400°C to 600°C up to full densification with formation of a vitreous layer;

and wherein the process further comprises cooling the heat-treated substrate at a cooling rate of from 1 to 10 K/min.

97. (new) The process of claim 96, wherein the heat treatment of the first stage is carried out according to alternative (A).

98. (new) The process of claim 96, wherein the heat treatment of the first stage is carried out according to alternative (B).

99. (new) The process of claim 98, wherein the heat treatment of the first stage is carried out

according to alternative (B) at an end temperature of up to about 200°C.

100. (new) The process of claim 98, wherein the heat treatment of the first stage is carried out according to alternative (B) at a residual pressure of ≤ 5 mbar.

101. (new) The process of claim 96, wherein the heat treatment of the first stage is carried out according to alternative (B) at a residual pressure of ≤ 5 mbar.

102. (new) The process of claim 96, wherein the heat treatment of the second stage is carried out at an end temperature of from 540° to 560°C.

103. (new) The process of claim 96, wherein the heat treatment of the second stage is carried out in an atmosphere which comprises ≤ 0.5 % by volume of oxygen.

104. (new) The process of claim 102, wherein the heat treatment of the second stage is carried out in an atmosphere which comprises ≤ 0.5 % by volume of oxygen.

105. (new) The process of claim 96, wherein the heat treatment of the second stage is carried out in an inert gas atmosphere.

106. (new) The process of claim 96, wherein the alkali metal silicate-containing coating sol is obtainable by a process comprising a hydrolysis and polycondensation of one or more silanes of

formula (I)



wherein the radicals X independently represent hydrolyzable groups or hydroxyl groups, the radicals R independently represent hydrogen, alkyl, alkenyl and alkynyl groups having up to 4 carbon atoms and aryl, aralkyl and alkaryl groups having from 6 to 10 carbon atoms, and n is 0, 1 or 2, with the proviso that at least one silane where n = 1 or 2 is used, or oligomers derived therefrom, in the presence of

- (a) at least one compound selected from oxides and hydroxides of alkali metals and alkaline earth metals, and
- (b) optionally, nanoscale SiO₂ particles.

107. (new) A process for making a metallic substrate having a vitreous coating, wherein the process comprises

- (a) applying an alkali metal silicate-containing coating sol to the substrate to provide a coating layer on the substrate;
- (b) drying the applied coating layer at room temperature of up to 100°C to obtain a dried coating layer, and
- (c) thermally densifying the dried coating layer of (b) by a two-stage heat treatment comprising,
 - (i) in a first stage, a heat treatment carried out either (A) in an atmosphere comprising from 15 % to 90 % by volume of oxygen at an end temperature of up to 400°C, or (B) in a vacuum at a residual pressure of

≤ 5 mbar at an end temperature of up to 200°C, and

- (ii) in a second stage, further densification by a heat treatment in an atmosphere that comprises ≤ 0.5 % by volume of oxygen at an end temperature of from 400°C to 600°C up to full densification with formation of a vitreous layer;

and wherein the process further comprises cooling the heat-treated substrate at a cooling rate of from 1 to 10 K/min.

108. (new) The process of claim 107, wherein the heat treatment of the second stage is carried out at an end temperature of from 540° to 560°C.

109. (new) The process of claim 108, wherein the heat treatment of the first stage is carried out according to alternative (A).

110. (new) The process of claim 108, wherein the heat treatment of the first stage is carried out according to alternative (B).